Fort Erie Underwater Recovery Unit Journal

October, 2013

This month's journal follows close on the heels of our last installment as far as establishing and maintaining neutral buoyancy. These techniques are universal regardless whether one chooses to dive wet or dry.

Many of us have been certified for longer than our newer members have birthdays. Thus, it's good to brush up on some of these skills. The divers of old had to be masters at buoyancy control without all the fan-dancy equipment available to keep and maintain it. With the arrival of the buoyancy compensating device or BCD, it became much simpler to acquire and maintain underwater trim.

We've all encountered the 'mud-puppies' who jump off a boat and hurl to the bottom only to leave a wake of mud and vis destruction in their path, ruining the site for the rest of us. A few simple techniques, once practiced and mastered, will go far to keep us out of this dubious category of rookiemanship.

Please take a few moments to review these simple techniques. Some are perfect to practice during our Unit practice dives at the St. Catharines Kiwanis pool the second Saturday of each month! What better place than a pool to determine your neutral buoyancy before a serious dive off a charter boat in the Caribbean. Lots of time and no embarrassment! Just be sure to bring the exact suit and equipment used during your away dive, then record your findings in your dive log.

You'll find that with practice, you will have better mastery over your attitude in the underwater environment at all times. You'll also begin to enjoy diving much more than ever before and be better able to concentrate on your surroundings instead of constantly fighting to maintain neutral buoyancy as you change your depth in the water column.

Acquiring and maintaining neutral buoyancy is the single most important skill to achieving mastery in the art of scuba diving and to truly enjoying your stay in that wonderful underwater world.

Buoyancy Control Techniques

On one hand, divemasters constantly urge you to look for the detail in the reef, the small critters and shrimp which may be no more than an inch long. That implies getting really "up close and personal" with the reef.

On the other hand, the same divemasters constantly warn us, "Don't touch anything!" And therein lies the problem: It's fairly easy to get close without touching, by swimming forward gently. But backing up again without hammering the reef with your fins, your knees or your elbows can be difficult.

The close-up view is just another of life's many situations that are easier to get into than out of. Nevertheless, skilled underwater photographers (a

Force it. Another option is to use your body weight to generate some downward momentum by lifting part of it out of the water, then letting it fall back. Lying on your face, *jackknife* your upper body downward, then lift your legs out of the water. The weight of your legs will drive you downward, and once your fins are in the water you can kick down.

What's the ideal amount of weight? With a nearly empty tank, say 500 psi, with lungs half full and with no air in your BC, you should be close to neutral at the surface--floating with the water at eye level, for example--and only slightly negative at your 15-foot safety stop. Some divers will be even lighter than that, so they're neutral at 15 feet. That makes them slightly positive as they ascend to the surface, but they can counter that by holding less air in their lungs and taking only shallow breaths. With a full tank, you should be about five pounds heavier, the weight of the other 2,500 psi of air. There are sometimes reasons to be heavier. When there is a lot of surge for example, a little extra lead helps you stay glued to the bottom. Always keep in mind however, that buoyancy control is easiest with a minimum amount of lead weight.

Once you get close to the right amount of lead, you can fine-tune it at your safety stop when your tank is nearly empty. Here's one way:

- Carry your smallest weight, one or two pounds, loose in a pocket or clipped to a D-ring so you can take it off easily.
- When you reach your safety stop with 500 psi left, hand it to your buddy temporarily or drop it to the bottom if the water is shallow.
- Now, try to get neutral again. Remember to keep your hands and fins as still as possible. Do the test next to a mooring rope for security if you need to, but remember you can always overcome a pound or so of positive buoyancy by exhaling and kicking downward. When you're making adjustments that miniscule, you don’t need to fear an uncontrolled ascent. If you can stay neutral at 15 feet without that small weight you took off, you don't need it, and your next dive will be easier without it.
- Now retrieve your weight from your buddy and do the same for him.

1. Trim

The next variable is trim - the position your body takes in the water when you're neutral and still. Trim is crucial to proper buoyancy, because if your fins are lower than your body, kicking to go forward will also make you go up. It'll seem you've suddenly become buoyant, so you'll vent air from your BC. Then, when you stop kicking, you'll be too heavy and you'll sink; constantly throughout your dive.

In order for kicking not to disrupt your buoyancy, your body needs to be trimmed so your legs are nearly horizontal and your fins push you only forward. Here's how to check for proper trim:

Once you are *exactly neutral*, hold your body absolutely still with your legs stretched out behind you. If your legs sink, you should move a little weight from your waist to a point higher on your body.

2. Tank Weight

Your scuba cylinder gets lighter as you dive and use up the air in it. The 80 cubic feet of air pumped into a full tank weighs almost exactly six pounds, and when you breathe it down to 500 psi, you've used up five pounds of that air, so the tank weighs five pounds less. That's a buoyancy shift that has to be countered by venting five pounds of buoyancy from your BC. And that explains why you should start a dive five pounds heavy - so you have five pounds of buoyancy in your BC to lose and still neutral at the safety stop.

Fortunately, this weight loss and buoyancy gain is gradual. If a tank can last you 60 minutes, it gains only about one pound in 10 minutes and you hardly notice it. Also, the tank's buoyancy gain is affected by depth only in the sense that you use up air faster when you are deeper. Because the tank is rigid, its buoyancy does not change immediately just by going 20 feet deeper or shallower.

So you'll have to adjust for the tank's buoyancy change, but it won't take you by surprise. You probably won't notice any change until nearly halfway through the dive.

Incidentally, it's not true, as many divers believe that you can escape this buoyancy gain by using a steel tank. Steel tanks are typically less buoyant than aluminum to begin with so they may end the dive slightly negative while an aluminum tank is positive. But 80 cubic feet of air weighs *just as much* in either tank metal, thus the buoyancy gain when you consume it is the same. Using a steel tank allows you to take a few pounds of weight off your belt, but you have to carry some or all of it in the tank itself, which is typically heavier.

3. Exposure Suit

Wetsuits float. There's no escaping the fact, because the same thing that makes neoprene warm makes it buoyant: gas trapped in thousands of tiny bubbles. While buoyancy (and warmth) varies, a new men's wetsuit has two to three pounds of buoyancy for every *millimeter* of thickness. So a thin tropical suit might have less than two pounds of buoyancy at the surface while a thick cold-water suit might have 20 pounds or more.

It's tempting to use a thinner suit to make buoyancy control easier. Some tropical divers wear no neoprene at all. But that's not a very good idea, because getting cold is fatiguing and increases your risk of decompression sickness.

The buoyancy of your wetsuit won't change noticeably from one dive to the next, but over time it does lose buoyancy as the thousands of tiny bubbles in the neoprene lose their resiliency and collapse or fill with water. At that point, the wetsuit has less buoyancy and less insulation than when new.

It stands to reason that if you keep your level of depth constant, your wetsuit's buoyancy won't change. Once you have your buoyancy dialed in for a given depth, you can forget it.

In addition, a thin wetsuit worn in tropical waters has so little buoyancy you can pretty much ignore any changes at depth.

4. Depth

Whatever the surface buoyancy of your wetsuit, it will change dramatically with depth. Because pressure flattens those thousands of gas bubbles, your wetsuit gets thinner and displaces less water. In effect, it gets heavier. The change is not linear. You lose half of your surface buoyancy in the first 33 feet of your descent and a third in the next 33 feet. Below 66 feet, there's only one-quarter of the original buoyancy left to lose no matter how deep you go. The single larger bubble in your BC behaves the same way.

Buoyancy changes fastest in the first few feet below the surface - three times as fast at one foot as at 60 feet. That's why it's often hard to get submerged, but once you're down five feet or so, you seem to get heavier and sink easily.

Unlike the buoyancy change in your tank, this buoyancy shift is *immediate* and works in both directions. When you ascend, you get back the buoyancy of your wetsuit and your BC instantly. So be alert to buoyancy changes whenever you change depth, especially on ascent.

5. Breath Control

Your lungs are a natural buoyancy compensator with about 10 pounds of buoyant lift. A normal, resting breath expands your lungs by about one pint, giving you one pound more buoyancy. Breathing in and out, your buoyancy fluctuates within a range of about one pound. But you can place that one-pound fluctuation almost anywhere in the total 10-pound range. You can breathe

from nearly full lungs and cycle between eight and nine pounds of buoyancy, for example, or you can breathe with nearly empty lungs and cycle between two and three pounds. So as long as you are nearly neutral with a half-breath, you can rise or fall at will just by controlling your lungs. *This is a secret many divers have never learned or mastered for perfect trim at any depth*.

6. Ballast Weight

The ballast weight you carry doesn't change during a dive, but it's usually the biggest problem. Most divers are overweighted; carrying more lead than they need. That makes buoyancy control more difficult because every extra pound of lead has to be balanced with an extra pound of buoyancy. To displace a pound of water and balance the pound of lead requires an air bubble in the BC of about *one pint* in volume.

But because an air bubble expands and contracts with depth changes, you have to be *constantly* adding or subtracting air from the bubble to keep that volume at one pint. Five extra pounds, which is not uncommon, means a five-pint bubble that grows and shrinks five times as much with depth changes and needs five times as much adjustment in order for you to maintain neutral buoyancy. So, extra lead means extra thrust up or down when you change depth, and requires constant adjustment to your BC valve controls.

Most dive instructors will agree that overweighting is a common problem. Quite often, many are also honest enough to agree that it's their fault. The instructor is worried about embolizing his students, thus he overweights them for the same reason your dad put training wheels on your first bike. Like the training wheels, the extra weight has to come off before you can graduate from the novice stage. Unfortunately, once you complete your checkout dives, your dive instructor then moves on to other students. When that happens, that leaves *you* to take off the training wheels yourself.

The first step is to just do it - take off two pounds before your next dive. Can't get below the surface? Before you reach for the lead again, make sure you really need it. Getting below the surface, especially on the first dive of the day, can be surprisingly difficult and can trick you into carrying more lead than you really need. *Here are a few tips*:

Be patient. The plush lining of a dry wetsuit can trap a surprising amount of air and thus buoyancy in its fibers, so it takes a minute or so to get fully saturated.

Reach up. Hold the inflator hose over your head and stretch it upward a little so its attachment point to your BC is highest. At the same time, *dip your right shoulder and squeeze the BC against your chest with your right arm*. This maneuver encourages the last few bubbles to find the exit.

Rock backward a little, and to the right. Many BCs trap a bubble of air just behind your head. Rocking backward as if you are in a La-Z-Boy recliner, moves the exhaust hose over the bubble and lets it escape.

Relax on descent. Many divers use their hands and feet far too much to establish trim, especially at the beginning of the dive. Without realizing it, their body is trying to climb out of the water. That generates upward thrust, making you seem lighter than you really are. To correct this, hold your right arm still at your side (your left is holding up your exhaust hose), extend your legs and point your fins straight down so they have the least resistance when sinking.

Exhale. Another manifestation of nervousness is a tendency to hold your breath, and a lungful of air adds as much as 10 pounds to your buoyancy. Exhale and hold it until you start sinking, then take *shallow* inhalations until you get below five feet.

In Summary...

Once you establish your ideal ballast weight and trim, you're well on your way toward perfect buoyancy control. Now you can fine-tune your BC inflation to compensate for the predictable changes due to using up your air and changing depth. Only then can you use breath control to drop gently down to see the smaller stuff, hover as long as you want, then lift harmlessly away. Your divemaster will be dazzled and amazed. It's not something he sees every day. Trust me; as a divemaster, I know these things!

There are many tricks, but pinpoint buoyancy control is the fundamental skill. Precise control of your buoyancy is what enables you to hover completely motionless, and then back out of the area without using your hands at all.

You can back out by simply ascending if you've approached from above, with your head well below your fins. And you can ascend without adding air to your BC by controlling your breathing. In fact, you'll improve your buoyancy control by using your BC less, not more.

At first glance, buoyancy control looks like a simple matter of balancing the downward force of your weights against the upward force of your BC inflation. When the two cancel out, you're neutral and can hover in the water. Since the lead in your BC pockets doesn't change after you enter the water, it seems as though you have only one variable to contend with: the upward thrust of your BC. It sounds easy, so why isn't it?

Pinpoint buoyancy control requires getting at least six things right. Once you get all six variables dialed in, you're good to go.

The ***six factors*** that affect your buoyancy are; **ballast**; **inflation**; **trim**; **exposure suit buoyancy**; **depth** and **breath control**. Your ballast weight and trim are the only two factors that, once you've selected them, remain constant. The others are variables, changing during the dive along with time, depth, or both. Some you can control, some you can't.

Buoyancy control isn't as easy as it looks, but with continued practice, you will have the instinctive buoyancy control of those underwater creatures you visit during your sojourns to the deep.

Stay tuned next month, for another exciting entry into the journal of the fascinating Fort Erie Underwater Recovery Unit. Until then…

THINK DEEP!